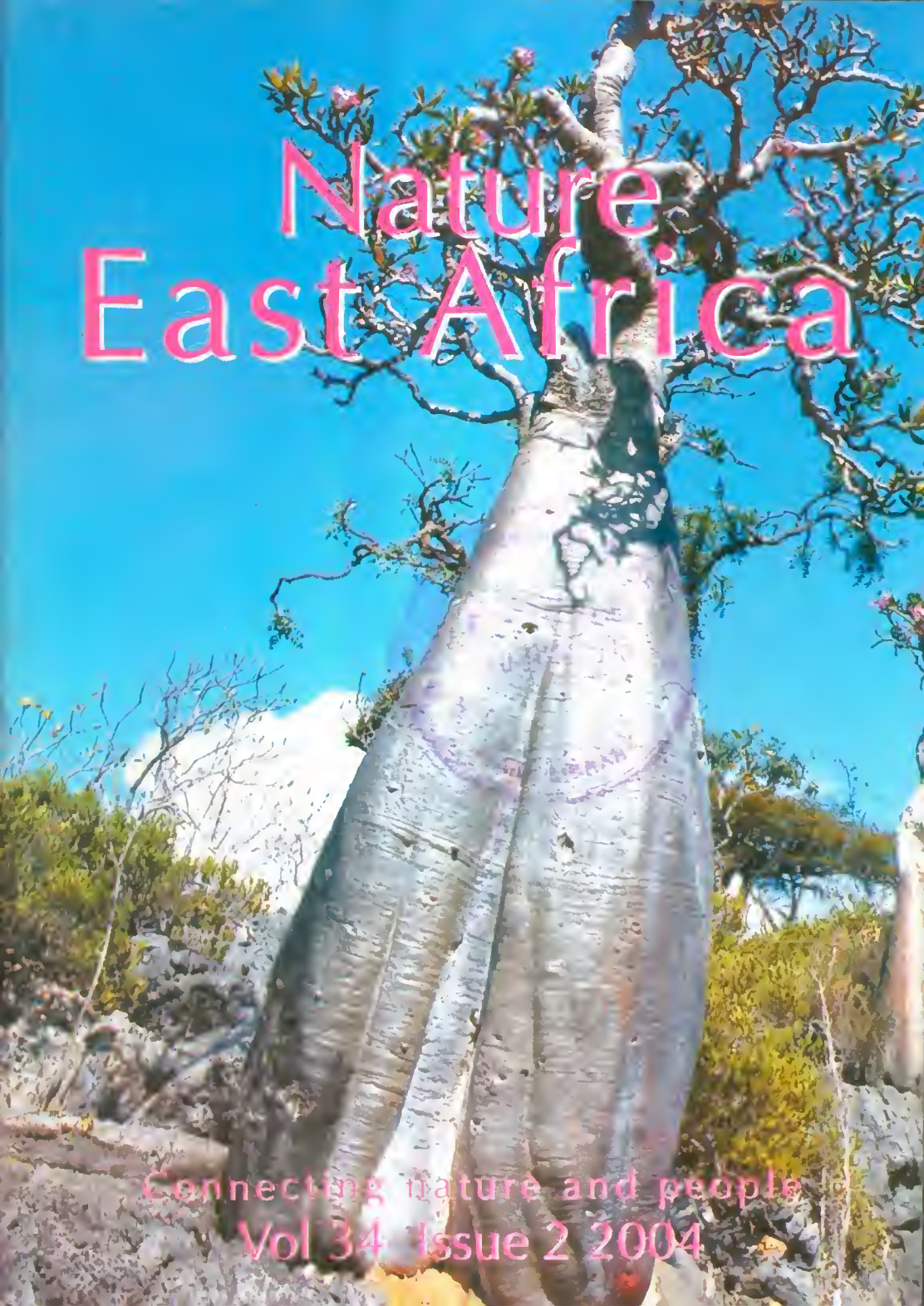

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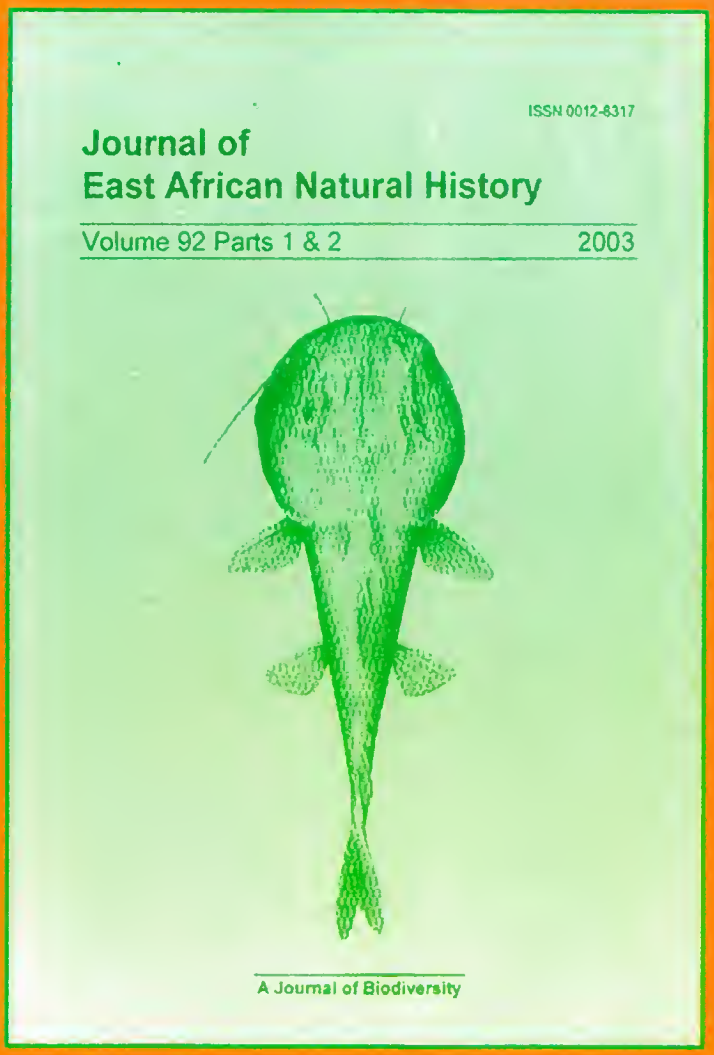

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Photo this and next page of Lake Solai by Tanguy de Bock

discrete sister of the Rift Valley Lakes…

by Tanguy de Bock
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The Rift Valley in Kenya hosts many a natural beauty. Follow the north-east to south-west line drawn by the Great Rift, and one will find lakes, forests, hills and breathtaking escarpments. There is the freshwater Lake Baringo, hot springs at Lake Bogoria and the spectacle of flamingoes at Lake Nakuru … but do Kenyans know that, stuck between Nakuru and Bogoria, is - discretely - a seasonal lake unique in its ecohydrology? What is the Lake Solai and who are its local inhabitants?

The Lake Solai water basin is situated north of Menengai Crater in Nakuru District, between Lake Nakuru 50km to the south and Lake Bogoria 20km in the north-west. The catchment covers an area of about 175km. Four main rivers drain into the lake and Maji Tamu, the biggest river, originates in the northern part of the Bahati Forest uplands. During the rainy season, many seasonal streams are created, flowing into gullies to join the rivers and the lake.

The climatic conditions in Solai are strongly influenced by altitude and physical features, and there can thus be considerable variation in climatic conditions on short distances. Described as semi-arid, the climate can however present annual rainfalls between 700 and 1000mm depending on the sources.

The Maji Tamu location, which includes the lake, hosts a sparsely distributed population of about 12,000 inhabitants, the majority of whom form a Tugen community, who

little known sites
Lake Solai

settled in the area in the late seventies when the former settlers sold their lands. The Tugens are agropastoralists who have now settled here and mostly practise mixed farming, by growing maize and keeping livestock. The livestock grazing tends to happen on individual land during the wet season, but around the lake and in the hills during the dry season. Some crops are grown under irrigation along the streams.

Along with the variable climate and a farmed watershed, the lake offers a unique ecosystem, which shows an interrelated set of characteristics mostly dependent on the season.

This lake seasonality is strongly related to the rainfall: most of the recharge in the lake happens at peak rainfall when a large proportion of the rain runs off to the lake. The variability in the precipitation is high within years and between years so that the environment is kept under regular change.

Annually, as the catchment undergoes peak rainfall in April/May and dry season from December to March a recurrent pattern can be seen: a very quick fill up phase in April and May, a little drop improved by August rains and then a long decline before March when the lake almost dries up. Changes in this pattern depend mostly on lack of rain in April and May or on unusual rains in the dry January/February months. Furthermore, the seasonality induces the water to change drastically from fresh to highly alkaline, creating quite remarkable physical and biotic conditions.

Four main vegetation zonations can be distinguished around the lake. The western side hosts a small *Acacia* and *Aeschynomene* forest where Nature Kenya's emblem can be seen perching gracefully on the tallest trees. In the north and east large *Sporobolus* and *Cynodon* grassland extend along with swampy vegetation such as *Cyperus laevigatus* and *Cyperus dives*. Egrets, plovers and crowned cranes dawdle there along with zebras and cattle. The river inlet to the south, finally, has the highest biodiversity and is the meeting point for many birds. Birds are numerous when the water is abundant and at certain periods the flamingoes and pelicans can cover the sky by thousands.

A number of environmental problems threaten Lake Solai. There is poor management of the natural resources, which is reflected in the loads of sediments reaching the lake and the water being often in shortage. Related to this, the catchment has a poor natural vegetative cover, as many trees are cut down for charcoal production and field clearing. In order to change this trend the community created, in 2001, a conservation association, called the Lake Solai Wetlands Conservation Association.

The association aims to conserve the lake and launch eco-tourism activities. A steady process in research on the lake, of awareness raising among the community, of capacity building supported by the Kenya Wildlife Service, has led the association to receive, at the dawn of 2005, its first "eco"-campers. Contacts for the group are: Lake Solai Wetlands Conservation Association, PO Box 216 NAKURU, KENYA Email lakesolai@yahoo.com
Tel 0720 146570 or 0720 884990

The camping site under the *Acacia xanthophloea* trees, which opens onto the lake shores, with the Rift Valley skyline in the background, leaves a peaceful and magnificent memory of a place which can now be shared by many a Kenyan.

new to science

Zanzibar's Recently Discovered Servaline Genet

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Servaline Genets *Genetta servalina* have long been known from Central Africa and isolated patches in East Africa, but it was not until the 1990s that they were documented on Unguja, the main island of the Zanzibar archipelago. In 1995 Tony Archer acquired a dried, somewhat damaged skin and skull in the village of Kitogani, in the south–central part of Unguja. This specimen was subsequently described as belonging to a new subspecies of Servaline Genet, *G. s. archeri* (Van Rompaey and Colyn 1998).

In January 2003 live Zanzibar Servaline Genets were photographed for the first time. Camera traps set up in Jozani–Chwaka Bay National Park yielded pictures of these endemic genets at four locations: two in the lush groundwater forest that comprises the heart of the park and two in the dry scrub to the north-east. As well as providing information about the genet's occurrence and distribution, these pictures have also added to our knowledge of its physical characteristics, including the colour of its pelt (Goldman and Winther-Hansen, 2003a; 2003b).

Like other members of the viverrid family which are adapted to forest life, Servaline Genets are boldly marked. Their bodies have black spots against a tan to ochre background and their long tails are ringed in black and light-coloured bands. The combined length of the head and body is about 41–50 cm, the tail is 35–44 cm long and they weigh in the range of 1 to 2 kg (Kingdon, 1997). That an animal of the Servaline Genet's dimensions and striking appearance can have eluded scientific discovery until just a few years ago on the flat, relatively small and very densely inhabited island of Unguja is challenging to explain, even if they are shy, solitary and nocturnal.

Rural Zanzibaris have of course known about the Servaline Genet all along and have described it in their own terms to curious naturalists. Unfortunately few researchers have systematically recorded the local Swahili dialect names for small carnivores or attempted to identify them in the field (the principal exception being Pakenham, 1959).

In the case of the Servaline Genet this problem is made more acute by the fact that it seems to be given different local names – and while some informants recognize these as the names of a single animal, others believe that they refer to different species.

In the course of our own field research on Unguja, over the past decade, we have elicited a number of different local names that individual informants give to the Servaline Genet – or at least to a small carnivore that partly matches its description – though there is by no means unanimous agreement on this score. The most widespread name is *ushundwi* (variant *ushundi*) and there seems to be little doubt that this is indeed a name for the Servaline Genet. A similar degree of confidence applies to another name, *uchui*, though this is much less widely known. This second name (and its variant *uchui umwangu*) refers to the leopard-like characteristics of the genet, *chui* being the common Swahili name for leopards.

The most widespread local name given the Servaline Genet is ushundwi (variant ushundi)

Informants are rather less certain about a third name, *uhange*, sometimes identified with *ushundwi* and *uchui*, but often described as a different animal, which is reddish in colour (though not to be confused with the rufous Zanzibar Slender Mongoose, *Herpestes sanguineus rufescens*).

Similar doubt exists over the proper application of another, less common, term, *ukwiri*.

Van Rompaey & Colyn (1998) suggest that both of these names – which were first recorded by Pakenham (1959) – might refer to the Zanzibar Servaline Genet, but this remains to be proven.

Further research is needed to sort out these ethnotaxonomic uncertainties, linking local names and descriptions to actual specimens and observations in the field. It may also be that the current inventory of Unguja's small carnivores is incomplete. The recent scientific discovery and photo-trapping of the Zanzibar Servaline Genet suggest that perhaps this small Indian Ocean island has yet to give up all of its zoological secrets. It is quite possible that Unguja is home to other undescribed endemic small carnivores, unknown to science, but known to rural Zanzibaris by one or more of the names discussed above.

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intrigue in nature

Sunbirds feeding on *Sansevieria* flowers

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Sansevieria flowers are phalaenophilous, which means that they are adapted for pollination by moths, in the order Lepidoptera (Faegri & Pijl, 1979). The adaptive features include nocturnal opening, strong sweet scent, production of nectar, and absence of bright colours. These features match the nocturnal activity, attraction by sweet scents, and nectar-feeding activity of moths. The flowers start to open shortly before sunset and close again soon after sunrise the following morning (Newton, 1994).

Very soon after sunrise another group of nectar-feeders start their feeding activity. These are the sunbirds, members of the aptly named family Nectariniidae. Unlike moths, they are diurnal and are attracted by bright colours, especially shades of red, orange and yellow. However, they have no sense of smell. Therefore bird-pollinated, or ornithophilous flowers are diurnal, have bright colours and plenty of nectar, but they have no scent. Typical ornithophilous flowers are found in the genera *Aloe* and *Leonotis*.

In late September 2004 I opened the curtains of a window at about 6.45 a.m., as the rising sun was beginning to brighten the day, and in the garden I noticed two sunbirds feeding from flowers on a plant of *Sansevieria bella*. After a couple of minutes they flew to the flowers of *Aloe francombei*, growing nearby, and then on to *Aloe lateritia* var. *graminicola*. It is typical of sunbirds that they move from one species to another, which is why seeds of aloes produced in a garden usually grow as hybrids. I observed the birds again for several mornings, and the visits to the *Sansevieria* flowers were always in the period 06:40 to 07:00 hours, approximately. From my photograph at left, the birds were identified by Brian Williams, as the Bronze Sunbird *Nectarinia kilimensis*, a common garden bird in Nairobi.

Observations on *Sansevieria robusta* (Newton, 1994) demonstrated that pollen-carrying moths visited flowers in the evening, approximately 19.15 to 23.00 hours. When bees were seen visiting the flowers early the next morning, it was found that the stigma was dry and probably no longer receptive. Similarly, the sunbirds that are the subject of the present note probably play no role in the pollination of sansevierias, as the flowers were beginning to close and the stigmas that I looked at were not glistening and probably no longer receptive. It is interesting that the birds managed to locate this extra source of nectar without the usual floral signal of bright colours.

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Shifting Pastoralism On Mt. Nyiru

by Bernard Agwanda
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Mt. Nyiru is on the eastern ridge of the Great Rift Valley in northern Kenya. It is situated about 50 km from the southern tip of L. Turkana, west of South Horr town. The mountain gradually rises to 2600 metres from flat lower land of about 1700 metres above sea level around Tuum town to the west and 800 metres around South Horr in the east. This relatively sudden rise of the mountain, particularly the eastern slope, has an advantage: the winds, which usually blow from east to west, are forced up the mountain. Consequently moisture carried with the wind is trapped on the mountain. In the process, an evergreen forest is nursed by the moisture retained on top of the mountain throughout the year. The streams that flow from this mountain provide water to Tuum and South Horr towns.

This afromontane forest is similar to those found on Mt. Kenya and Mt. Elgon. The trees in this forest include Podocapus, *Xymalos monospora*, *Teclea nobilis* and Bamboo. Gap or edge shrubs and lianas include *Chlerodendrum johnstoni*. There are also several large forest glades like the ones found in Kakamega forest. What a contrast to the largely desert background of the surrounding area!

The mammals of the area include Striped Hyena, Bushpig, Bushbuck, Porcupine, Leopard, Baboon, Ochre Bush Squirrel and several kinds of rats and mice. Large mammals such as elephant and buffalo also existed here until about 50 years ago and their jaws and skulls are not hard to find in the forest. What happened to the large mammals is hard to tell and there are two existing stories. One story explains how in the 1960s there was a campaign to eliminate excess wildlife to give room for human settlement. In this campaign there was a serious agenda of making wealth from ivory trade and game skins. The elephant population in this forest was literally butchered, to the last individual, for their tusks. The other story is that Samburu herdsmen drove elephants and buffalos from the forest when they invaded it with their livestock, during a prolonged drought.

The local community is largely Samburu. The Samburus are pastoralists and prefer open savannah as long as there is grass and water for their livestock. The savannah ecosystem is made of open grasslands, shrubland or may be open wooded grassland. Lowland grass around Mt. Nyiru provides pasture for the livestock only during the rainy season April-December. The first 3 months of the year are characterized by drought. This may change from year to year, following weather change.

Drought presents a major challenge to the pastoralist Samburu, who then lack water and pasture for their livestock. The Samburu then move a lot from one place to another in search of water and pasture.

At such a time, the evergreen afromontane moist forest with its green vegetation and grass in the glades becomes very attractive. The Samburus thus, osmotically, move to the mountain forest from the poor pasture in the lowland. They move into the forest, build their *manyattas* and graze their cattle, goats and sheep. The livestock feed on the young trees, herbs on the forest floor, low canopy trees, shrubs and grass in the glades.

The Samburus depend on meat and milk from their animals. The meat and milk is often from goats and rarely from cattle. They are therefore keen on certain pastures or particular plants that make goats give more milk or become fatter.

During this expedition, I realized that most trees of *Xymalos monospora* are cut with branches still lying strewn all over the ground. The cut branches are of different ages, meaning they were cut at different times. Some were rotten, some starting to rot, while others are half dry. My Samburu guide readily answered my question on this and explained: 'Lkukut ni mzuri kwa mbuzi; inaleta maziwa mingi, tena inanoneza mbuzi'. Lkukut is the Samburu name for *X. monospora* which they say makes the goat fat and milky. Besides goats like it and so they cut high branches of this species for the goats to feed on.

This harvesting was sustainable before 1997. Then in 1997, the Turkanas attacked the Samburus with firearms, and robbed them of livestock. The Samburus were overpowered by guns and forced to escape to the safe haven of Mt. Nyiru forest. According to the locals around Tuum and South Horr towns, the Turkanas were unable to climb the mountain and get into the forest. When the Samburu home guards were armed, they still hid their wives, children and livestock while men went to fight their enemies downhill. This means the forest was grazed for a longer time than normal. The Samburus only managed to go back down hill towards the end of 1999. During our expedition up to 12 deserted *manyattas* were observed in the forest. Two *manyattas* were still in use, but the owners had just a few goats and cattle. Most Samburus moved down hill after peace was restored.

Currently two forces modify Mt. Nyiru forest besides the weather pattern: grazing by livestock and fire. Fire is a threat because Samburus use fire to harvest honey from wild beehives, which they readily sell to a large local processing factory. Fire often escapes and spreads outside the target area. With an increase of visits to the forest, even during the wet season, coupled with a longer drought period and a larger human population, conservation management is needed more than ever. The local honey factory could demonstráte the use of modern beehives!

The forest is a place worth a visit.

CHEMICAL BATTLES IN THE 'CASTLES OF CLAY'

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Social insects play an important role in tropical ecosystems. Of the two largest groups of social insects, the ants (Hymenoptera) are abundant predators, and the termites (Isoptera) are important in the recycling of organic matter and nutrients in the soil. Their abundance makes them the target of other animals as food. For example the diet of the Aardvark is predominantly composed of termites and ants. But even more subtle strategies to exploit social insect colonies exist. Several insect groups (called termitophiles) manage to invade termite nests and to feed on resources available within the nest. Termitophiles seem to be treated like real nestmates and termites apparently even feed them.

Termites form well-defined colonies, and many grass feeding species defend territories around their nests. Termites use recognition cues to distinguish between nestmates, non-nestmates, or non-specifics (Adams, 1991). In recent years it has become evident that chemical substances on the cuticle of termites provide sufficient information for nestmate recognition (Kaib et al., 2002 & Kaib et al., 2004). These substances are long chained hydrocarbons, which vary in chain length, saturation and branching. Furthermore, individual compounds may differ considerably in concentration. Hence, the composition of hydrocarbons on the cuticle is a complex chemical mixture, here on referred to as the hydrocarbon profile.

The hydrocarbon profile differs considerably among species (Kaib et al., 1991 & Bagine et al., 1994), and within a species among colonies. Evidence for hydrocarbons being nestmate recognition cues in termites comes from behavioural experiments, where the aggression among termite workers from different colonies was measured. In several studies, a surprisingly good correlation of the intensity of

aggression among colonies versus the difference in the hydrocarbon profiles among these colonies was found (Kaib et al., 2002 & Kaib et al., 2004). Hence, hydrocarbon profiles are quite similar to the bar code on products sold in supermarkets, providing the information needed to distinguish nestmates from non-nestmates. When intruding into a termite nest, termitophiles have to acquire the termites' bar code to get access to the colony. Otherwise, they would be recognised as strangers and be attacked.

Several groups of staphylinid beetles are termitophilous. These beetles are found in the colonies of fungus growing termites like *Macrotermes* and *Odontotermes,* as well as in some other termite genera like *Amitermes* and *Cubitermes*. The genus *Macrotermes* builds the fascinating "castles of clay" (Fig. 1), which can be found in considerable densities across several parts of Kenya. A good example is along the Marigat-Nakuru road.

Macrotermes herus

On this site in March 2002, within the central part of one colony of *M. herus,* we found several individuals of a beetle species with a swollen (physogastric) abdomen. These individuals were determined to belong to the species *Termitobia herus* by D. A. Kistner, (California State University) (Fig. 1).

M. jeannelli

Termitobia herus

Fig. 1. The mounds of two sympatric termite species, *Macrotermes herus* and *M. jeannelli* , and a dorsal view of the termitophilous beetle, *Termitobia herus*. The physogastric (swollen) abdomen of the beetle is conspicuous.

Dr. J. Darlington (Cambridge) collected the type specimen in 1983 in the same area as our 2002 study site. In Baringo District, another *Macrotermes* species occurs (formerly called *M. subhyalinus*, but which is a different species, tentatively named *M. jeannelli*). Within *M. jeannelli* colonies, Dr. Darlington found a different *Termitobia* beetle

(*T. darlingtonae*), which suggests that termitophilous beetles are rather host specific. The two termite species, *M. herus* and *M. jeannelli* are abundant in the study area with overlapping distribution range, but our density data suggest that the two species show different density patterns (Fig. 2).

During maturation, *Termitobia* beetles develop a physogastric abdomen. According to Kistner (2001), physogastric termitophiles get their food directly from termites. He suggests that through food ingested by the termites, a substance might be transferred causing physogastry in the termitophiles, perhaps the same substances causing physogastry in termite queens.

Nevertheless, the biology of *Termitobia* suggests that these beetles succeed in breaking the information code of termites and using this code to get accepted by the termites and to be treated as nestmates. Given that cuticular hydrocarbons provide the nestmate recognition cues, the beetles' hydrocarbon profiles should match those of their host colony.

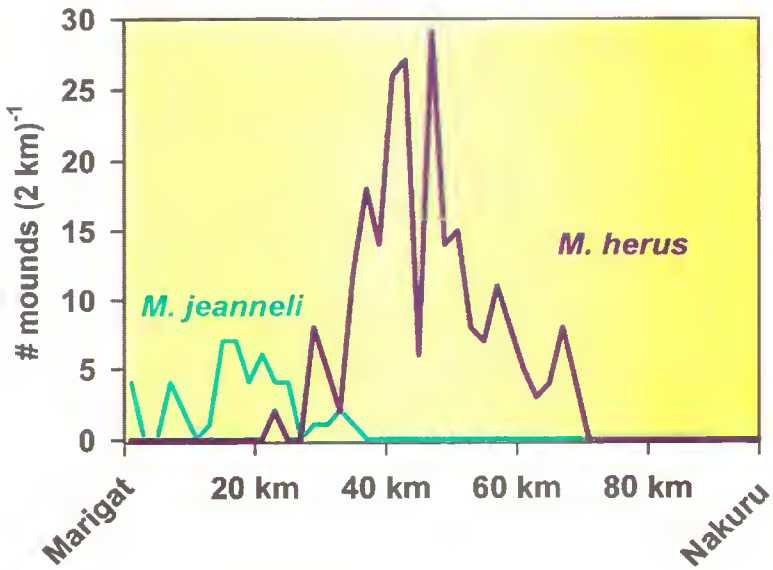

Fig. 2. Spatial distribution of *Macrotermes herus* and *M. jeannelli*, measured as frequency of mounds in a 50 m wide corridor along the Marigat – Nakuru road. The distribution fluctuates in an anti-parallel manner.

We compared hydrocarbon profiles of the *Termitobia* beetles with *M. herus* termites of the same (host) colony, and with two neighbouring colonies of a related termite species, *M. michaelseni*. In short, hydrocarbons are washed from the cuticle of individual insects using hexane, and the washes were chemically analysed by gaschromatography (Kaib et al., 2002).

In Fig. 3, we present examples of chromatograms from a *M. herus* termite major worker and of a *T. herus* beetle from the same termite colony. Also a profile of a *M. michaelseni* major worker is shown. For detailed analyses, the hydrocarbon profiles of *M. michaelseni* workers, *M. herus* workers from each of three colonies, and profiles from four individual beetles were compared.

From these analyses, several interesting details became apparent. First, comparing different *Macrotermes* taxa, different species had considerably different profiles, assuring species recognition. Second, the hydrocarbon profiles from the three sampled colonies of *M. herus* had very clear differences among the colonies. Third, the profiles of the termitophile beetles were almost congruent with those of termites from their host colony. Hence, beetles use chemical camouflage for invading termite colonies and are not attacked, since they are not recognised as strangers.

This is one of many fascinating examples of the subtle chemical warfare between termites and termitophiles. At present, it is not known how the beetles manage to acquire profiles specific for the host termite colony. However, their success in breaking the information code of termites may have contributed to beetles getting intimately linked to one particular host species. As termite species differ in hydrocarbon profiles, a beetle species adapted by evolution to one termite species would not be able to use another termite species as its host. At least the beetles of the tribe Termitopaediini are all host specific on ecological time scales. It would be interesting to study the coevolution link for other taxa of termitophiles.

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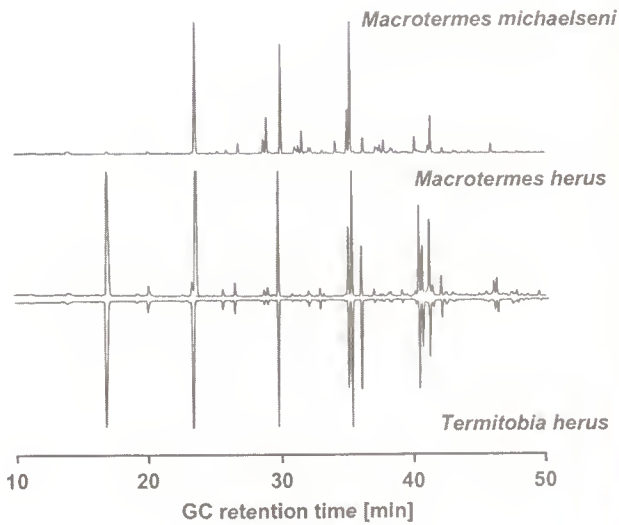

Fig. 3. Gaschromatographic traces of the hydrocarbons from a major worker of *Macrotermes michaelseni*, and from a *M. herus*, as well as from the termitophile beetle *Termitobia herus*, respectively. The profiles demonstrate species-specific hydrocarbon profiles in the two termite species and a striking congruency of the profiles between the termite host *M. herus* and its guest beetle.

Socotran Desert Roses (*Adenium obesum sokotranum*) thriving here on limestone rock in the Haghir Mountains are larger and exhibit more swollen trunks than the species that grow on mainland Africa.

SOCOTRA

Some botanical highlights seen through a layman's eyes

by Rupert Watson
Images by Nigel Pavitt

This article is a personal view of some of the plant life of an extraordinary island. It could be far better researched, and rhetorical questions could be answered by perusing large reference books or surfing on the Internet. But rather than catalogue what's there I want to share some of the thoughts it stimulates and some of the wonder and awe, which Socotra's plant life generates in the visitor. In this case it was a visitor arriving with an almost blank botanical slate, marked only with the light chalk of eighteen plant species mentioned in the United Nations Development Programme's guide to some of the environmental highlights of the island and leaving a week later with many memories, some facts gleaned from local island guides, and a whole load of accumulated astonishment.

Socotra is about 200 kilometers off the Horn of Africa and almost twice that far from the Arabian peninsular. Human history has tied it much more closely to Arabia than to Africa, and politically it belongs in Yemen. Biogeographically though, it is far closer to Africa, and its flora and fauna reflect ancient ancestral connections to the Continent. A modern physical map of earth, complete with underwater contours, clearly shows Socotra linked to the African mainland by a paler wash of shallow sea, through which also protrude three smaller islands - enough, apparently, to qualify Socotra as an archipelago.

The main island of Socotra is 120 kilometers long, and for much of this length about 40 kilometers wide, although this dimension in particular gives absolutely no indication of travel time. There is an expectation that distant oceanic islands will be either coral atolls, a few hundred years of global warming away from submersion, or formed by tapering volcanoes which long ago thrust their way up through the water's surface from the ocean floor. Socotra is neither. Its centre is spectacularly rugged, with jagged peaks scraping the clouds over 1500 meters above sea-level, then sweeping down to high limestone plateaus; from these drop huge cliffs, sometimes almost straight into the sea, or onto flat coastal plains which end in huge curves of surf-beaten beach.

Umbrella-shaped Dragon's Blood Trees (*Dracaena connabari*) are endemic to Socotra Island and flourish above 3,000 feet. Their closest relative is found on the other side of the African continent in Morocco and the Canary Islands.

Socotran Frankincense trees (*Boswellia elongata*) – one of seven endemic species found on the island - flourish in the Homhil Mountains.

Generally, rainfall is low, which has meant none of the island's plants has evolved to reach good tree height, and if that fails to describe size with sufficient botanical accuracy, just consider that there is nothing on the island big enough for fishermen to hollow into dugout canoes.

That such different landscapes, each with distinct micro-climates, should support a great range of plant life, comes as no surprise, but nothing quite prepared me for the diversity, or the bizarreness, of Socotra's flora. Botanists can immerse themselves in a list of around 900 species (about a third of which are endemic to the island) and will be able to see many of these in wider Arabian or African perspectives. Having no knowledge of Arabian plant life, I found myself always looking for African connections, and inevitably the few species I was able to place in their taxonomic contexts at least had close African relatives.

On the coastal plains around the airport we were shown expanses of Socotran Croton *Croton socotranus*, growing between two and three meters tall and about the height of the familiar orange-leaved Croton *Croton dichogamus* of Nairobi National Park and elsewhere. By the end of our travels a week later, it was apparent this was the most widespread shrub on the island, but for all its adaptability to Socotra's different climatic regimes, it is only found there. It had much more of the flat-topped shape of an *acacia* (of which there are four species on the

island) and having neither fruit nor flowers in November, whatever characteristics were responsible for its inclusion in the *Croton* genus were not obviously apparent.

Members of Euphorbiaceae are also to be found in Socotra, particularly the Socotran Tree Euphorbia *Euphorbia arbuscula*. Reaching seven or eight meters in height, this is as close to a tree as anything on the island, sufficiently resembling our *Euphorbia candelabra* to make one wonder if they both evolved from the same ancestor. A thick web of woody branches fan out from its trunk, like the gills below the cap of a mushroom, ending in green succulent stems. Filled, characteristically, with white eye-burning sap, in the young and tender stage. These are still apparently palatable to livestock. This tree is known both from Socotra and Samha, the tiniest of the other three islands in the archipelago. Endemic to one of the other islands, Abd al Kuri, is *Euphorbia abdelkuri*, whose clusters of succulent, segmented stems grow straight out of the ground like leafless bamboos.

Getting to Socotra

To reach Socotra, means flying from Yemen - and a few days in Sana'a is yet another good reason for visiting the island. There is currently one flight a week from Sana'a, and, less reliably, one a week from Aden, so visits are generally in multiples of seven days. The arrival of the Friday morning flight at the capital, and almost only town, Hadibu, gives the impression of being the island's social event of the week, not least because the plane brings in supplies of miraa, fresh enough to keep its consumers chewing for at least the next three days. The Summer Land Hotel in Hadibu has a few beds in basic rooms. Travellers are encouraged to organise their visits through the newly formed Ecotourism Society (scdp@y.net.ye), which can arrange vehicle hire, camping gear, scuba diving and snorkelling equipment and any necessary permits. The construction of an all weather airstrip allows larger planes to land at Hadibu than was previously the case. This results in air connections being open all year round, although the June-October winds can be very debilitating for visitors.

An endemic Socotran Aloe (*Aloe perryi*) grows in the Dixam area of the Haghir Mountains.

The dried juice of Socotran aloes has been famous for centuries. It is considered more potent than any other aloe. Harvesting takes place in the heat of summer when women and girls use leather bowls to collect juice from selected leaves in a sustainable way.

If I were to pick Socotra's national plant, a top contender would be the Desert Rose *Adenium obesum* sub-specific *sokotranum*. These cover whole hillsides and when in full flower must be a spectacular sight. Particularly memorable were one or two bursts of deep pink flowers backed by the brilliant blue of the sea. Morphologically this subspecies is much taller than its African relatives, with trunks far thicker and the clusters of leaves even more disproportionately tiny. How, one wonders, do these plants absorb enough sunlight just to tick over, let alone grow?

Actually, on further thought, the national plant can only be the Dragon's Blood Tree *Dracaena connabari*, so called by its bright red resin, harvested in crystalline form by slicing into the trunk. Like the Tree Euphorbia, this too is a small tree. From a distance the two species have very similar silhouettes but close up, the successively forking branches of the Dragon's Blood, tipped with dry spiky leaves, are uniquely distinctive. The tree's history is no less romantic than its name – it is said that Roman soldiers carried a bag of crystals, to apply as war paint, or to rub into their wounds to staunch the bleeding - and Socotran women still swallow infusions of the resin to stem internal bleeding after childbirth.

The Dragon's Blood's nearest relatives grow in Morocco and the Canary Islands, off the west coast of Africa. Does this imply that long ago, at least before Socotra broke off mainland Africa, when the Sahara was savannah, and thick forest fringed the Mediterranean, a continuous belt of ancestral trees stretched from one side of Africa to the other? If both these populations derived from a common ancestor, how else could they be where they are today?

The island oozes evolution, the stage of a vastly stimulating play about change by trial and error. Everywhere are plants and animals whose histories and relationships shout out questions of how this and why that? Some ignorance helps foster the sense of mystery, but even a good grounding in evolutionary theory is not going to do much more than inform the guesswork. The date loosely used to mark the start of Socotra's geographical independence is ten million years ago. The distinction between island and continental flora is obviously much less marked than it is in Madagascar, whose island status dates back perhaps ten times as far. However, ten million years is still long enough for Socotra's flora to have headed in very different directions from its mainland relatives. Plants on both islands evidence the luxury of evolving in the absence of large herbivores (the only indigenous mammals on Socotra are bats) not least by so many of them being thornless (as is *Acacia pennivenia*, the island's only endemic member of the family), which of course finds them ill-prepared to withstand the attentions of domestic stock.

One of the most spectacular products of this blessed environment is the Cucumber Tree *Dendrosicyos socotrana*, the only tree-like species in a family whose members are far better known for creeping along the ground or up the trunks of forest giants. It has a large swollen cylindrical trunk, topped with a drooping canopy of leaves, and in times of drought is particularly vulnerable to the machetes of local farmers who cut the trees for stock fodder. The Socotran Fig *Dorstenia gigas* is even more bloated, and is becoming increasingly confined to rocky cliffs inaccessible to goats.

The Socotran Pomegranate (*Punica protopunica*) is the only wild relative of the pomegranate tree, which is widely cultivated for its fruit in the tropics.

The Dragon's Blood trees are far from being the only ones whose sap is much sought after. From that of some of the seven endemic species of *Boswellia* is derived powerfully aromatic frankincense, while *Commiphora ornifolia*, one of the four endemic species of the genus on the island, produces myrrh. This can be bought from the Eco-tourism Society's centre at the airport, but the trees of neither genus are remotely endangered. Even better known for its juices is the endemic aloe, *Aloe perryi*, renowned at least two thousand years ago for producing a purgative, and more recently as a cosmetic additive.

Socotran Pomegranates *Punica protopunica* are said to be the only wild relatives of all the domestic varieties. Up until 1985 these wild pomegranates were thought extinct, and the fact they are actually quite easy to find in certain areas gives some idea of how little scientific attention the island has received.

In 1880 a botanist called Balfour undertook a botanical survey of Socotra, which identified over 200 species then new to science. Today, all those are still to be found on the island, and anyone going to the island after the rains can still look out for Socotran Begonia *Begonia socotrana*, Socotran Violet *Exacum affine* and Socotran Caralluma *Caralluma socotrana*. We can be proud that these and all those other 200+ species are still there. For this to continue, those shaping Socotra's future will need to take some tough decisions in the face of rising human populations, their higher living standards and parallel increases in demand for fuel, grazing and timber. It is all too easy to take the seemingly easy option and begin offering up a frighteningly fragile environment on the sacrificial altar of so-called development.

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Conventional wisdom has it that grasses are the classic example of wind-pollinated plants. Indeed, the inconspicuous flowers of most grasses, which are more like stiff glumes than petals, have anthers hanging from filaments and a feathery stigma so that they can be whipped around in a soft breeze. They are clearly intended to either distribute or catch wind-born pollen. Inconspicuous as they may be, grass flowers are usually held above the rest of the foliage where wind may most effectively disperse the pollen. The grass glumes held above the green leaves dry out first, looking like whitecaps on waves of grass. Grass pollen contributes substantially to air-borne pollen, pollen that causes misery to those with allergies or "hay-fever".

But there is little in nature that does not have its exceptions, and grasses also defy strict stereotypes. When insects are seen visiting grass flowers, it has generally been thought that this is a kind of "pollen theft" – that no real pollination is taking place. But there is a class of grasses that are clearly insect pollinated.

The scarcity of grasses in the understory of thick forest has been attributed, at least in part, to the still air under a thick forest overstory that does not allow grasses to reproduce. Some grasses in the tropical rain forests of South America – all herbaceous relatives of bamboos – seem to have reverted to insect pollination (Soderstrom and Calderon 1971).

natural history
Bees associated
with Grasses

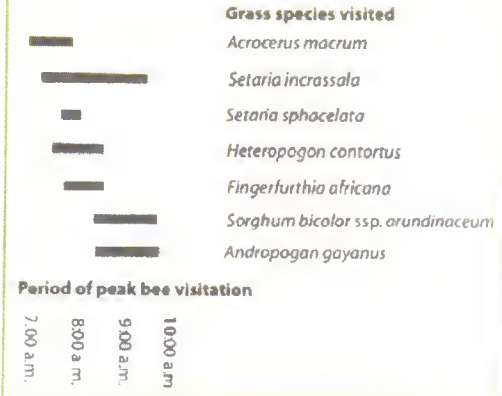
This group of grasses has spike-like inflorescences, that are brilliant hues of yellow when the anthers are ripe. One of these grasses even bears flowers on bladeless culms that burrow through the soil, permitting the flowers to emerge almost underground, amongst the leaf litter – a behaviour that is not explicable if the grass is wind-pollinated. The flowers of these grasses are primarily visited by stingless bees, thrips and flies. The relationship between the latter and the grasses is partially beneficial, partially parasitic, in that the flies often lay eggs on the inflorescences, and the larvae eat the seeds, yet clearly help to carry out pollination in the process.

There is a rich diversity of herbaceous bamboo-like grasses in Africa, particularly in moist forests such as in the Eastern Arc Mountains of Kenya and Tanzania, but their pollination requirements are not known.

Africa has its own complexities of bees visiting grasses, involving different grasses and different bees. Early in the morning in the Laikipia Plateau during the rainy season, one can often see thousands of honeybees buzzing through grassy swards, picking up pollen from the flowerheads of *Cynodon dactylon*. To a lesser extent, honeybees can also be observed gathering pollen from a *Cenchrus* sp. Dino Martins and I observed this phenomenon at Mpala Research Centre in September 2003. Wanting to know more about why honeybees would visit grasses, we got hold of an excellent 1962 article published in the Proceedings of the Linnaean Society of London on "Grass Pollination by Bees in Kenya" by A.V. Bogdan, then working at the Grassland Research Station in Kitale.

Bogdan noted that honeybees gathering pollen from grasses is a common phenomenon in Kenya, particularly from *Cynodon dactylon* and grasses of the genuses *Brachiaria* and *Setaria*. He included an interesting anecdote as well from an experiment at the Grassland Research Station, where over 200 species and varieties of indigenous Kenyan grasses were cultivated in small nursery plots. At first, honeybees visited only the species mentioned above along with a few others, within these plots. But in subsequent years, the bees spread their activity to a large number of grass species. Bogdan was convinced that they "learned", over time, a new behaviour to collect pollen from grasses that they had not known before, moving on even to include flowers with loose panicles and thus quite difficult to handle. Bogdan observed, "often one can also see a bee hanging on by one front leg, clinging either to the stigma or even to one of the filaments and working frantically with the other five legs". Once bees had learned such habits, he found that they seemed to become quite specialized, and he could not force them to collect pollen or nectar from other plants, even in cages.

As with all honeybee foraging, a single bee, known as a scout, discovers a food resource. It returns to the hive and recruits other bees to visit the source of food. This behaviour makes honeybees very efficient foragers, as they can exploit abundant resources en masse. We collected a number of honeybees foraging on both grasses. In each case, the pollen baskets were filled with pollen only from the grass species the bee was caught on. This further supports the 'loyal', focused foraging tendencies of honeybees.



Graph illustrates period of greatest bee visitation to grass species in Range and Forage Institute nursery, Roodeplaat, South Africa, during flowering seasons of 1993-94 and 1994-5. (Immelmann and Eardley 2000, reprinted with permission of author)

On the *Cynodon dactylon*, honeybees foraged hanging onto the grass spikelet group, working from one end to the other. On the cylindrical spikelet group of the *Cenchrus* sp., they worked over the spikelets in a spiral along the length of the flowering portions. In this way all open, dehiscing anthers are visited systematically on each flowering grass spikelet. Sometimes more than one individual honeybee was seen on a single grass spikelet group, but more often each spikelet group had a single honeybee. Hundreds of others could be seen coming and going, and flying about searching for unoccupied spikelets.

Honeybees have also been seen visiting flowering maize (*Zea mays*), in western Kenya. Here they forage in the large pollen-bearing flowering tassels on the top of the plant. In the US honeybees visit maize when they are in need of pollen resources. However, since most maize on large commercial farms is regularly sprayed, this ends up poisoning the bees and sometimes even the honey.

In the observations of Bogdan, he noted that the only other insect he observed at Kitale regularly collecting grass pollen are bees of the genus *Nomia*. The particular group of *Nomia* bees that Bogdan was observing were probably members of the species that have now been segregated into the *Lipotriches* genus; many of them restricted to Africa, and many of them very fond of gathering pollen from grasses.

What is so interesting is that in almost all instances:- what we have seen in Kenya, Bogdan's earlier observations, the observations of Immelmann and Eardley in South Africa, is that bees visiting grasses seems to be a learned behaviour. In South Africa, at the nursery of Range and Forage Institute near Pretoria, small plantings of native grasses were established to produce seed. The nursery had been designed to minimize cross pollination by wind, and it was therefore disconcerting to find that three species of the same genus, *Lipotriches*, and honeybees, were observed visiting 21 of the 84 species of grasses planted in the nursery, and probably effectuating some degree of pollination. Excavation of *Lipotriches* nests (long burrows into the ground, often on the compacted soil of footpaths) showed that the "pollen loafs" prepared for the larvae to eat, as they emerged from eggs, were all made of grass pollen. Yet the species of grasses visited changed each year, with relatively few overlaps. Rather than selecting species of flowers, the bees seemed to be most influenced by what was flowering near their nests, and the time of anthesis. As grass anthers lose their pollen to the wind rather quickly after anthesis, the visiting bees showed peak activity at a grass species

within 20 minutes after anthesis and then moved on to other grasses reaching their peak flowering somewhat later.

There is much to be learnt about bees foraging on grasses, and whether they play a role in their pollination ecology. Bees - both honeybees and other native bees - may learn to exploit the unconventional resource of grass pollen when an opportunity presents itself. Most likely, this is only of benefit to the bee, not the grass - or not most grasses. But observations by us earlier on a bee-sampling trip in Tsavo suggest that one of the dryland grass species, *Dignathia hirtella*, may be insect pollinated. The spikelets on this species are well-spaced and there is a distinct corrugated landing-platform, - seemingly designed for an insect visitor. A mystery waiting to be solved!

Much remains to be learnt about the insect visitors to flowering grasses in Kenya.

Acknowledgements

The above observations were made during a bee-sampling trip sponsored by the United Nations Food and Agriculture Organisation and the Plant Protection Research Institute of South Africa, conducted by the African Pollinator Initiative (API).

API's motto is "To promote pollination as an essential ecosystem service for sustainable livelihoods and the conservation of biological diversity in Africa." For more information, please contact the API secretariat, email: dinom@elci.org

Feature

Bloodthirsty SPIDERS & SYRINGES with wings

by Robert R Jackson

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THE MOSQUITO TERMINATOR

There are more than 2,500 mosquito species in the world, most of which feed on the blood of vertebrates, including mammals, birds, frogs, lizards and occasionally even fish.

Mosquitoes evolved during the Jurassic, and they probably fed on dinosaur blood. Blood, however, isn't the only food for a mosquito. Instead of feeding on blood, male mosquitoes go to flowers and drink nectar, and females may also top up a blood meal by visiting flowers for sugar.

Getting blood from larger animals is a challenge that the female mosquito has overcome by using specialized skin-piercing mouthparts. No spiders feed on vertebrate blood in this straightforward way. We discovered that they don't have to. *Evarcha culicivora* is an East Africa spider that feeds indirectly on vertebrate blood by actively choosing as prey, specifically those female mosquitoes, that have fed within the past 24 hours on blood. In other words, the mosquito finds and collects the blood and then *E. culicivora* finds and eats the mosquito.

An adult male of *E.culicivora*, with a bright red face, gets blood by feeding on the malaria vector, a female of *Anopheles gambiae* that has itself been feeding on human

Evarcha culicivora, along with another 5,000 species, is a jumping spider (family Salticidae). Jumping spiders are exceptional animals because of their unique, complex eyes and have intricate vision-guided predatory strategies. *E. culicivora*, however, is the only jumping spider, and in fact the only predator of any kind, known to seek out specifically blood-carrying female mosquitoes as prey.

A SPIDER LABORATORY ON THE SHORE OF LAKE VICTORIA

Godfrey Otieno Sune, one of the primary researchers responsible for what we know about the mosquito terminator

Evarcha culicivora is known only from the vicinity of Lake Victoria in Kenya and Uganda, its typical habitat being the base of a tree trunk or the wall of a building. When quiescent, it hides in the grass or other vegetation close to the ground, but feeding individuals move to more exposed locations, often entering our houses.

At Mbita Point, on the shore of Lake Victoria in western Kenya, mosquitoes and this mosquito terminator are common, and at the Thomas Odhiambo Campus of the International Centre for Insect Physiology and Ecology, we have a spider-rearing facility and an experimental laboratory. Over the years, the research team has included Godfrey Otieno Sune, Silas Ouko Orima, Stephen Abok Alluoch, Jane Atieno, Ximena Nelson, Fiona Cross and Simon Pollard.

Lake Victoria, Africa's largest lake and the second largest freshwater lake in the world, straddles the equator and feeds an entomological and arachnological tidal wave of staggering diversity. Two kinds of storms blow up from Lake Victoria, only one of which is conventional and wet. The other storms come in on gigantic dark clouds that tower up to 50 metres above the water. Out of these clouds pour six-legged 'raindrops', known technically as chaoborids and chironomids, but more often called simply 'lake flies'. Mosquitoes are only a small minority in the teeming insect masses at Mbita Point, but *E. culicivora* is an expert at finding these needles in a haystack. This is why we call it the 'mosquito terminator'.

MALARIA

Mosquitoes are good for delivering blood to *E. culicivora*, but they're bad for us. Many diseases are spread by mosquitoes, the most notorious being malaria. Malaria isn't unique to people, and many other animals get their own versions of this disease. Technically, malaria is a disease caused by *Plasmodium*, a one-cell parasite. There are many species of *Plasmodium*, four of which cause malaria in people. All four can be found in Africa, but one in particular, *Plasmodium falciparum*, causes about 95% of the malaria deaths in the world. Every year, *Plasmodium falciparum* is responsible for several million deaths in Africa, but these grim malaria statistics tell

us only part of the story. Malaria also has many indirect consequences, including hard-to-quantify economic costs.

Plasmodium's life cycle presents the human immune system with a bewildering parade of different beasts, a moving target in the war against malaria. When an infected mosquito feeds on blood, it leaves saliva behind, and the parasite goes along for the ride. This form of the parasite, called a 'sporozoite', travels in the blood stream to the liver and finds a home in a liver cell where it makes more parasites by the thousands. From the liver, the parasite moves back to the blood, but now as a new form called a 'merozoite'. Merozoites are especially clever at getting into red-blood cells where they can evade our immune system. In the red-blood cell, merozoites become trophozoites, and the trophozoites busy themselves making more trophozoites, destroying the red-blood cells in the process.

A small percentage of the trophozoites make yet another beast, the gametocyte. If a feeding mosquito happens to take in gametocytes, things happen in a hurry. Inside the mosquito, gametocytes turn into sperm and eggs, which find each other and make a new active organism called an ookinete. The ookinete buries into the lining of the mosquito's gut and becomes an oocyst. Now the oocyst reproduces, making about 10,000 sporozoites, and the sporozoites make their way to the mosquito's salivary glands where they wait to be injected into the next human victim.

This may sound complicated, but these are only a few of the pieces needed for understanding malaria. For example, mosquito biology is also important, and mosquito biology is also complicated. The environment and history are also relevant.

IN STANLEY'S FOOTSTEPS

Besides being the source of a mosquito-eating spider, Lake Victoria is also the source of the Nile, or more technically the White Nile, which used to thunder out of the north shore near Jinja in Uganda. A dam at Jinja now tames the head waters of the world's longest river.

It was John Speke who named the lake after Queen Victoria. This was in 1859, when he and Richard Burton were returning from Lake Tanganyika, horribly sick with malaria and both thoroughly sick of each other. Running out of supplies, Burton let Speke wander off on his own to look for another big lake rumoured to lie to the north. On the south shore, in present-day Tanzania, Speke found it and returned. Without having explored the lake or seen a river, he announced to the Royal Geographic Society, and the world, that he had found the source of the Nile. Burton objected to how Speke turned a hunch into a 'fact', without bothering with proof, and relations between Burton and Speke went progressively downhill from there. Speke later returned and reached Jinja, but he still didn't explore the lake. Nor did he follow the river all the way downstream. It's easy to understand why he didn't. The Nile zigzags through Uganda and, when the Nile veered off to the west, Speke took shortcuts.

It's also easy to understand why, when back in England, Speke wasn't looking forward to defending his claims about the Nile in a scheduled public debate with Burton. This had been arranged by the Royal Geographic Society. The prospect of facing Burton's legendary intellect and debating skills must have been daunting, but the debate never happened because Speke shot and killed himself in a mysterious 'hunting accident'.

From Mbita Point, clouds of lake flies can be seen over the water of Lake Victoria, with Rusinga Island in the background

Later, Samuel Baker filled in the missing pieces of the river's path, but whether Lake Victoria was truly the source of the Nile remained unresolved. You might wonder what all the fuss was about. Nowadays, we look at a map and see a big lake extending from Tanzania in the south to Jinja in the north, but somebody had to prove that what Speke saw in the south actually was part of one big lake with Jinja at the other end. Somebody also needed to prove that no other big rivers poured into the lake that fed into the river at Jinja.

Still later, Henry Morton Stanley explored Lake Victoria thoroughly, confirmed that Speke's hunch was right, and got malaria. This was Stanley's second expedition to East Africa. He was already famous for his first, when he found a lost missionary and left behind history's most delightful greeting, "Dr Livingstone, I presume".

Things have changed, and a scientist complaining about email being slow or a Land Rover getting stuck in the mud, is a far cry from the early days of European exploration. One thing, however, is disturbingly the same. Malaria, a fact of life in the 19th Century, is still with us in all its fury.

The author hunting for the mosquito terminator in grass on the shore of Lake Victoria

MOSQUITOES

In the 19th Century, while explorers searched for the source of the Nile, biologists searched for the source of malaria. In 1880 Charles Laveran, while working in Algeria, proved that malaria is caused by the single-cell parasite we now call *Plasmodium*, but the connection between malaria and mosquitoes had a more turbulent history. For Giovanni Grassi and Ronald Ross, working on malaria research had something of the effect as the search for the Nile had with Burton and Speke. History has given Ross primary credit for demonstrating that mosquitoes carry *Plasmodium* from person to person, but Ross was vague about the mosquito species he studied. It was as though, for Ross, a mosquito was just a mosquito. Grassi, who knew better, did not concede credit to Ross and it was Grassi, along with Bignami and others, who filled in the missing pieces that proved the link between malaria and mosquitoes. Yet the Nobel Prize was awarded to Ross alone. Whether this was just might be uncertain. However, one thing is certain. The particular mosquito really does matter.

Human malaria depends on mosquitoes from one particular genus, *Anopheles*. In Africa, one species in particular, *Anopheles gambiae*, matters the most. With this mosquito, the malaria parasite has found the ultimate taxi for moving from person to person. This is because *A. gambiae* has an exceptionally long lifespan for a mosquito and a remarkable predisposition to feed almost exclusively on people.

THE MALARIA VECTOR MEETS THE MOSQUITO TERMINATOR

Finding a spider that singles out mosquitoes is welcome news in Africa, but wouldn't it be even better to find a spider that singles out *Anopheles*? That's asking too much. Or is it?

Adults and large juveniles of *E. culicivora* feed on a wide variety of mosquito species, but the smallest juveniles of *E. culicivora* (the first instar) appear to have narrower preferences. Remarkably, they single out *Anopheles* as preferred prey. Many people have trouble finding a mosquito in a crowd of lake flies, and even more trouble sorting out which mosquito is an *Anopheles*. It's easy to sympathise with Ross. Yet the first-instar of *E. culicivora* makes these fine-grain discriminations with apparent ease, despite having eyes and a brain that are minute by human standards.

A small juvenile of *E. culicivora* eating a blood-fed female of *Anopheles gambiae*

A first-instar *E. culicivora* is only 1.5 mm in body length. It's remarkable that a salticid so small can bring down a mosquito at all, but *Anopheles* is uniquely vulnerable because the small juveniles of *E. culicivora* adopt an *Anopheles*-specific tactic. *Anopheles* rests with its abdomen tilted up. Upon seeing a blood-filled *Anopheles* female, the small juvenile of *E. culicivora* plots a path that will bring it around behind the mosquito and under its raised abdomen. From underneath, it fires up and brings down the mosquito.

In our modern global economy, malaria in Africa is a burden that affects the whole world. Yet it continues to frustrate hopes for simple solutions or a magic bullet. Having found a predator that specializes on *Anopheles*, we shouldn't be slow about investigating how it might contribute to realistic measures against malaria. It's also nice knowing that, like the vast majority of spiders, *E. culicivora* is harmless to people. With its bright red face and big cat-like eyes, this attractive eight-legged friend is a welcome guest in our homes.

books in review

Society for Medicinal Plant Research
Gesellschaft für Arzneipflanzenforschung

50 Years 1953 - 2003
A Jubilee Edition

by Dr Siro Masinde
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EA Herbarium, National Museums of Kenya

Sprecher, E. & Caesar, W. (eds). 2003. Society for Medicinal Plant Research: 50 years 1953-2003 – A Jubilee Edition. Wissenschaftliche Verlagsgesellschaft mbH, Stuttgart. 172 pp.

The book, published in 2003, is a special edition to mark the golden jubilee of the Society for Medicinal Plant Research (in German, *Gessellschaft für Arzneiflanzenforschung* (GA)). GA publishes the well established medicinal plant journal, *Planta Medica*, that was also started in 1953. The book is in two main parts. Part A deals with the foundation and history of the Society and part B with its aims and activities. The foundation and history covers the personalities that were instrumental in the founding and growth of the Society, activities of the Society starting with the first congress in 1953 at Bad Camberg near Frankfurt, the history of *Planta Medica* and the GA Newsletter founded in 1978. The Society grew from being German focused to its current international status with membership across many countries.

The aim of the Society is the *"...unification of all scientists interested in medicinal plant research and application from breeding and cultivation via pharmacognosy to therapy..."* Five review papers on medicinal plant research are given in part B. Among the topics covered are GA and phytopharmaceuticals, phytomedicines, tracking bioactivity in plant extracts – new concepts and approaches, and plant cell, tissue and organ cultures as tools for the elucidation of biosynthetic pathways.

World interest in natural products such as medicinal plants and cosmetics is currently high. Use of medicinal plants flourished in most parts of the world including Kenya before the advent of modern medicines. In most societies knowledge on medicinal plants was passed on orally from one generation to another. In traditional African medicine, healing is holistic and consists of the physical, psychological and spiritual well being of an individual. Healers are often associated with sorcery and witchcraft. There are also many quacks. This bad image has led to little growth or research in this area.

A similar image existed in Europe for a long time. Societies such as GA were instrumental in encouraging research in medicinal plants so that they can be better understood and utilized properly. It is unfortunate that countries of the world where medicinal plants are most in use have done little to promote research and understanding of the healing properties of plants. In Kenya, research and use of medicinal plants is increasing partly due to the realization that complementary medicine is important for the good health of the Kenyan people, a majority of whom cannot afford modern medicines. Medicinal plants are also widely used in the treatment of livestock in rural areas. The surging interest in natural products is however creating problems associated with unsustainable exploitation of medicinal plants with the result that the survival of many species is now threatened. Good examples of medicinal plants that are harvested unsustainably in Kenya include various *Aloe* species, *Prunus africana* (Red Stinkwood), and *Warburgia ugandensis*.

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